

Title: Let's Quilt It!

Brief Overview:

This learning unit involves analyzing, observing, and collecting geometric patterns. The students will apply these skills independently, cooperatively, and in groups. Students will apply rules and functions in algebraic equations. Students will also explore the historical value of quilts in identifying historical images. From their work, they will create their own. Join us and cozy up with the quilt of many patterns!

Links to NCTM 2000 Standards:

- **Standard 2: Patterns, Functions, and Algebra**

Mathematics instructional programs should include attention to patterns, functions symbols, and models so that all students understand various types of patterns and functional relationships; use symbolic forms to represent and analyze mathematical situations and structures; and use mathematical models and analyze change in both real and abstract contexts.

- **Standard 6: Problem Solving**

Mathematics instructional programs should focus on solving problems as part of understanding mathematics so that all students build new mathematical knowledge through their work with problems; develop a disposition to formulate, represent, abstract, and generalize in situations within and outside mathematics; apply a wide variety of strategies to solve problems and adapt the strategies to new situations; and monitor and reflect on their mathematical thinking in solving problems.

- **Standard 7: Reasoning and Proof**

Mathematics instructional programs should focus on learning to reason and construct proofs as part of understanding mathematics so that all students recognize reasoning and proof as essential and powerful parts of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proof; and select and use various types of reasoning and methods of proof as appropriate.

- **Standard 8: Communication**

Mathematics instructional programs should use communication to foster an understanding of mathematics so that all students organize and consolidate their mathematical thinking to communicate with others; express mathematical ideas coherently and clearly to peers, teachers, and others; extend their mathematical knowledge by considering the thinking and strategies of others; and use the language of mathematics as a precise means of mathematical expression.

- **Standard 9: Connections**

Mathematics instructional programs should emphasize connections to foster an understanding of mathematics so that all students recognize and use connections among different mathematical ideas; understand how mathematical ideas build one another to produce a coherent whole; and recognize, use, and learn about mathematics in contexts outside of mathematics. *Reference: Social Studies Connection: The identification of patterns in quilts.*

- **Standard 10: Representation**

Mathematics instructional programs should emphasize mathematical representation to foster an understanding of mathematics so that all students create and use representation to organize, record and communicate mathematical ideas; develop a repertoire of mathematical representation that can be used purposefully, flexibly, and appropriately; and use representation to model and interpret physical, social, and mathematical phenomena.

Grade/Level:

4-5

Duration/Length:

The learning process will be 5-6 one hour class periods that are not necessarily consecutive.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Basic operations (+, -, x, ÷)
- Geometric names and shapes of pattern blocks
- Multi-cultural quilt folk-tales

Student Outcomes:

Students will:

- acquire a knowledge of patterns from a historical perspective.
- design and complete a series of pattern strips displaying numerical rules.
- communicate rules and functions that apply to their individual patterns.

Materials/Resources/Printed Materials:

- Overhead projector
- Math journal

- A vocabulary list
- Rhythmic pattern words
- Graph paper
- 25 one inch squares per student
- Patterns collected by students-found in art, sculpture, and cloth
- Manila folders for portfolio and work space
- Writing paper
- 1 inch grid paper
- 12x4 manila sentence strips
- Classroom magic markers, crayons
- Teachers charts:
 - Teacher Resource 1 - Pattern Block Patterns (for duplication)
 - Teacher Resource 2 - Transparency (CLAP)
 - Teacher Resource 3 - Transparency (SNAP)
 - Teacher Resource 4 - Rubric Worksheet

Development/Procedures:

Social Studies Connection: The discussion of quilts can begin at any time during this unit. Stories can be used to include: *The Patchwork Quilt* by Valerie Flourney; *The Keeping Quilt* by Patricia Polacco; *Sweet Clara and the Freedom Quilt* by Deborah Hopkinson; *Eight Hands Round, A Patchwork Alphabet* by Ann Whitford Paul; and *The Quilt* by Ann Jones. A visit to a magazine rack will provide examples of contemporary quilts. Students may have quilts at home to bring in as examples.

Teachers explain to the students the historical significance of quilts. Quilts were made from the old clothes of family ancestors to use. Some quilts told stories of family trials and triumphs. These folk-tales are colorful and creative. Today quilting continues, not as much out of necessity, but to carry on the tradition. Some contemporary quilts tell stories. The stories on present-day quilts could be compared to the stories told in the past.

TEACHER PREPARATION: Display numerous pattern pieces of multi-cultural images in the classroom (e.g., artwork, sculptures, clothing, tiles, materials, etc.)

Have students prepare math portfolios where their work will be saved.

ACTIVITY I: We are planning to explore the art in quilt patterns. It is time to pull out the geometric shapes and get started. You are in the classroom and everyone has a part in designing the classroom quilt. We are going to look at the geometric patterns and enjoy the comforts of design.

Materials:

25 one inch squares per student
Overhead projector
Clear blocks
20 sheets of grid paper
Math tool – Plastic sheet with geometric shapes cut out
Teacher Resource 2 - Transparency (CLAP)
Teacher Resource 3 - Transparency (SNAP)
12x4 manila sentence strips

Task 1. Sound Patterns: Teacher can use the projector to demonstrate a rhythmic pattern. Teacher will guide students in this patterning. Use the overhead and Teacher Resource 2 - Transparency (CLAP). This should be fun!!! Ask students to explain what is happening in the picture. Can they think of some way that clapping could create a pattern? Students will understand that the patterns in body rhythms.

Use the overhead and Teacher Resource 3 - Transparency (SNAP). Ask students to demonstrate how to “snap” their fingers. Can they create a snapping pattern? Can they combine clapping and snapping to create a pattern?

Task 2. What Do You Know About Patterns? Ask students where they have seen different creations of patterns. Record answers in Math Journals. Volunteers will share responses with the class. Record answers on a chart paper. Responses should vary.

***Math Talk Chart:** Mathematical vocabulary is to be added to a chart labeled “Math Talk - Work in Progress”. As words such as shape, size, position, sequence, proximity, etc., are added to the chart, the words are defined and used. Students are encouraged to incorporate this vocabulary in their discussion.











Task 3. Pattern Arrangements: Distribute pattern blocks (or colored geometric shapes from Teacher Resource 1). Students will use the blocks to create different shapes in groups of four. After a short period, the teacher will demonstrate how to create a pattern using the overhead projector with translucent pattern blocks. Teacher projects pattern blocks and asks the class to identify different ways these blocks can be arranged. Explain to the students that whole sides of the pattern blocks must touch. Use pattern blocks squares to show some examples and incorrect examples of arrangements. (Patterns should be horizontal. There are instances where a core can not be identified and therefore, it is an incorrect arrangement.)

Advise students that all pattern blocks should be flat. Students will be asked to create a repeating pattern. The vocabulary words term and core should be introduced at this time. **Term** is considered one block in a given pattern; and the **core** of a pattern is a complete sequence that repeats.

*On a strip of paper (card stock), have students create a repeating pattern. Color. On the back, write the type of pattern it is. Add to the student's portfolio. This is piece number 1 of the classroom quilt in Option 2 at the end of the unit.

Task 4. Quilt Exploration in Reading: With the students, read and examine the quilting patterns, *Eight Hands Round*. Distribute 1-inch grid paper to students. Using the math tool, ask students to pick three shapes with which to create quilt patterns. Record patterns using those shapes on the grid paper. (For homework, they can color the designs.) After creating all possible designs, explain how they are different. Point out that the patterns have to be congruent in order to fit together. Would one student's fit with another student's? Which students could fit the patterns together? Why or why not? (Understanding this is important. When individuals make quilts the squares are congruent. If they were not, the quilt would not come together to form a rectangle. This is important for Option 2 at the end of this unit.)

Task 5. Naming the Terms: In pairs, students will design a pattern containing at least three repeated cores and to stop before the fourth core is completed. Teams will complete each other's patterns. Share a few students' examples with the entire class. Teacher will identify the terms using letters (variables).











 A A A B B, A A A B B AB, AB, AB, AB

Students will identify patterns using variables instead of the names of shapes. Using work they completed earlier, or using the math tool, students can use variables to name the cores of the patterns.

Task 6. Evaluation: Teacher will distribute manila strips to students. Using markers, students will create a pattern having two full cores and leave one unfinished. On the back of this strip, the student will write his/her name, the type of pattern it is (repeating), and write the pattern using variables. Pattern strips are collected, place in the student's math portfolio. It can be used for review during the unit or used for the quilting strip in Option 2 as noted below.

* Color the strip created in Task 6. This is piece number 2 of the classroom quilt in Option 2 at the end of the unit.

Task 7. Homework. Students will bring to class examples of patterns (e.g. artwork, sculptures, clothing, etc.)

ACTIVITY 2. - Recognizing functions and writing algebraic rules and explanations.

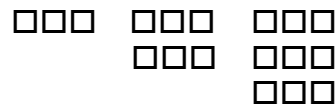
Task 1. Students will review and explain the core sequence patterns in the different artwork they brought to class. Students will be introduced or review the construction of rules and functions based on a pattern that is demonstrated by the teacher. In this task, students will recognize how quilts grow as squares are added.

Materials: Each student will have approximately 25 one-inch squares.

Vocabulary: Math Talk Chart! Include following words on the chart: inverse, table, and repetition.

Directions:

Give each student about 25 square pattern blocks. Teacher will instruct students to build a rectangle using the 3 squares. Demonstrate table. Continue to enlarge the second row and third row, creating a larger rectangle. (Explain the difference between rows and columns. Rows are horizontal, while columns are vertical. This activity involves rows).



Example - Task 1

(Input) No. of Rows	(Output) No. Of Squares
1	3
2	6
3	9

Ask students to investigate the relationship between the number of rows and the numbers of squares. Tell the students to write the rule that applies to the relationship. Challenge students to add the 4th row. Have them test their rules in the 4 lines that the have completed.

Teacher question: How many squares would be in row 15? Write: How do you know?
Teacher question: If you have a rectangle formed in horizontal rows that has 135 squares, How many rows do you have? How do you know? Write your explanation.

Answer: Function: Row \times 3 = Squares; Row 4, 12 squares; Row 15, 45 squares;
(Inverse) Squares \div 3 = Row; Row 45, 135 squares.

Note: Students will see that the number of squares increase by 3. The rule, or function, allows students to find the number of squares in Row 25 without counting by 3's up to that row. They should come to understand that the row number is multiplied by 3. Other examples may be needed.

*On a strip of paper (card stock), have students create a growing pattern. Color. On the back, write the type of pattern it is and its rule. Add to the student's portfolio. This is piece number 3 of the classroom quilt in Option 2 at the end of the unit.

Task 2 - A Word Problem: Present this to students.

A weaver puts 2 pounds of cotton on a spinning wheel that spins thread. From his 2 pounds of cottons, he extracts 6 feet of yarn (string). He adds another 2 pounds of cotton and now has 12 feet of thread. How many feet of thread will he have after he has added another 2 pounds? Another 2 pounds?

Encourage students to build a table, identify the relationships, write a rule, and test it.

Extension question: How many yards of yarn will the weaver have after putting in 20 lbs. of cotton?

Next extension: If he had 210 feet of yarn, how much cotton did he have on his spinning wheel? Test. Write: How do you know?

Assessment note to teacher: Did student write the inverse of the operation to solve the extension question?

Answer: 2 lbs., 6 feet; 4 lbs., 12 feet; 6 lbs., 18 feet; 20 lbs., 60 feet; 70 lbs., 210 feet.

Rule: $3X = Y$; $Y \div 3 = X$, where X is lbs. and Y is feet.

Task 3. Framing a Quilt: Students will continue investigating patterns, rules, and functions. Quilting squares are usually connected and then the quilt is framed. Sometimes each square is framed or rows are framed. This math problem focuses on framing squares.

Ariana has created a number of quilt squares. (Each is one square foot.) She needs to determine how many feet of material she needs to frame her squares if she places them in a long row. Use your pattern squares (1") to determine the number of feet she needs to:

Frame one square? ☐ How many feet of fabric are needed to frame this square?

Students connect two squares. Determine the feet around squares?

Connect a third square. How many feet are needed now?

Write the rule. Test your rule by connecting the fourth square.

Expansion question: How many feet would she need if she connected 20 squares?

Write: How does your rule work? Why does it work?

Adriana looks at her framing fabric and she has 66 feet of material. How many square blocks can she frame? Write the rule. Test it 3 times. Why does it work?

Answer: Square 1, 4 feet; 2 squares, 6 feet; 3 squares, 8 feet; 4 square, 10 feet; 32 squares, 66 feet.

Rules: $2X + 2 = \# \text{ of feet}$; inverse: $(\# \text{ of feet} - 2) \div 2 = \# \text{ of squares}$

*On a strip of paper (card stock), have students create this pattern. Color. On the back, write the type of pattern it is and its rule. Add to the student's portfolio. This is piece number 4 of the classroom quilt in Option 2 at the end of the unit.

Task 4. - Final Product - Creating a classroom quilt from our patterns.

Option 1. One square per student

Students will review the work and patterns they have created, and they have added to their portfolio. Each student will have the option of choosing one finished piece they believe to be their best. Using a 12"x12" piece of paper, the student will copy that pattern onto the quilt square, with the option of using fabric, material, yarn, etc. Student will present the square to the class and explain the pattern sequence or rule.

Option 2. Connecting pattern strips and linking with others.

Students will collect the pattern strips from Tasks 1 - 4. Each student will arrange his or her pattern strips from Tasks 1 - 4 or any additional strips to create a quilting square. Make sure that each strip is the same size. Place them face down and tape them together. Do not overlap! Take 2" strips of color paper and frame the rectangle. Do not overlap! Each student should have a large rectangle, but they should all be the same size, just like in a bed quilt. Now, put them next to each other and tape together to form a large paper quilt. Or hang them on a bulletin board.

Performance Assessment:

Each student will be assessed at the end of each task according to the rubric that has been distributed to students. Students will also perform a self-assessment using the checklist on the student rubric. The portfolio will be reviewed with each individual student to discuss growth and strengths.

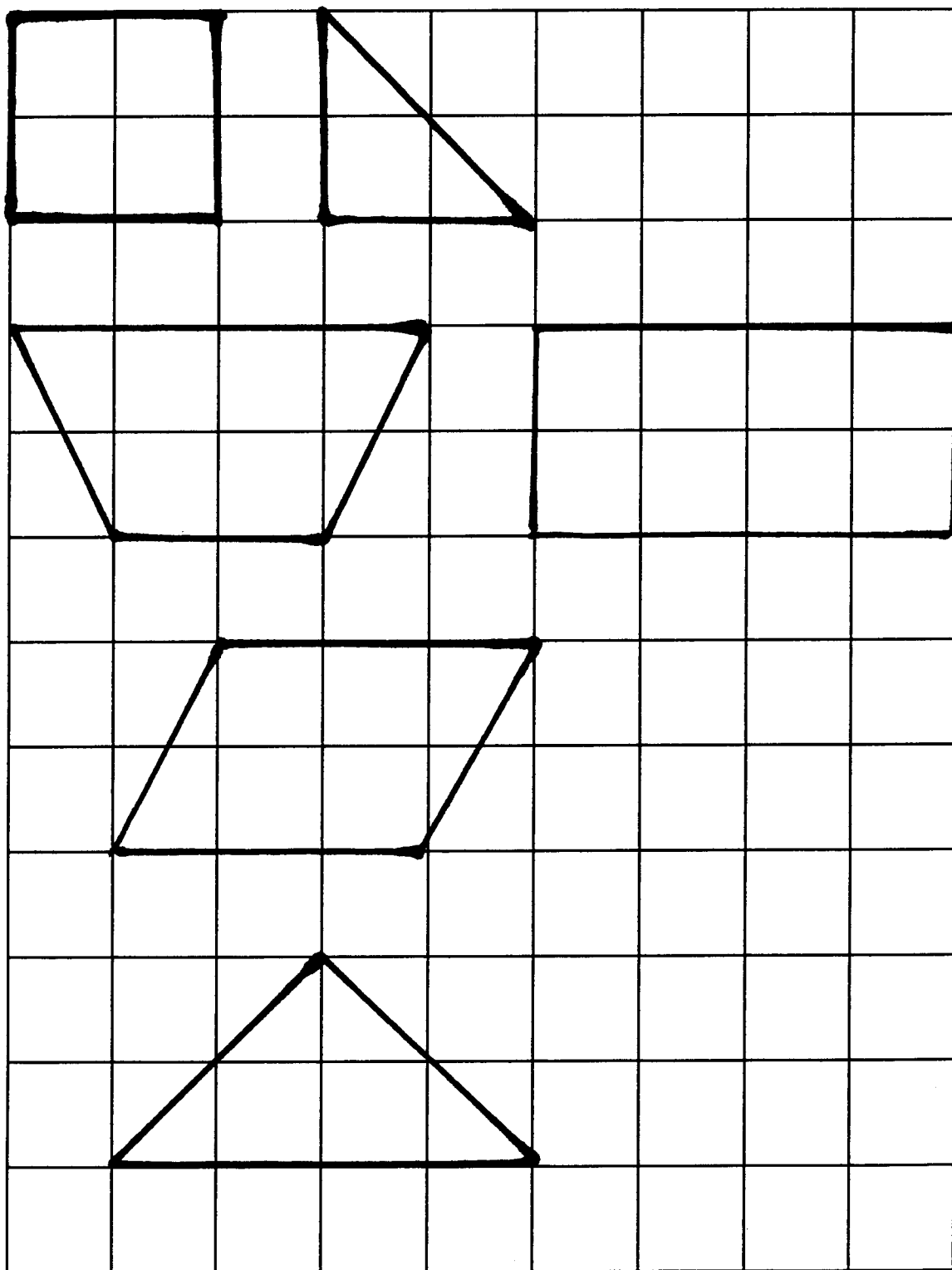
Extension/Follow Up:

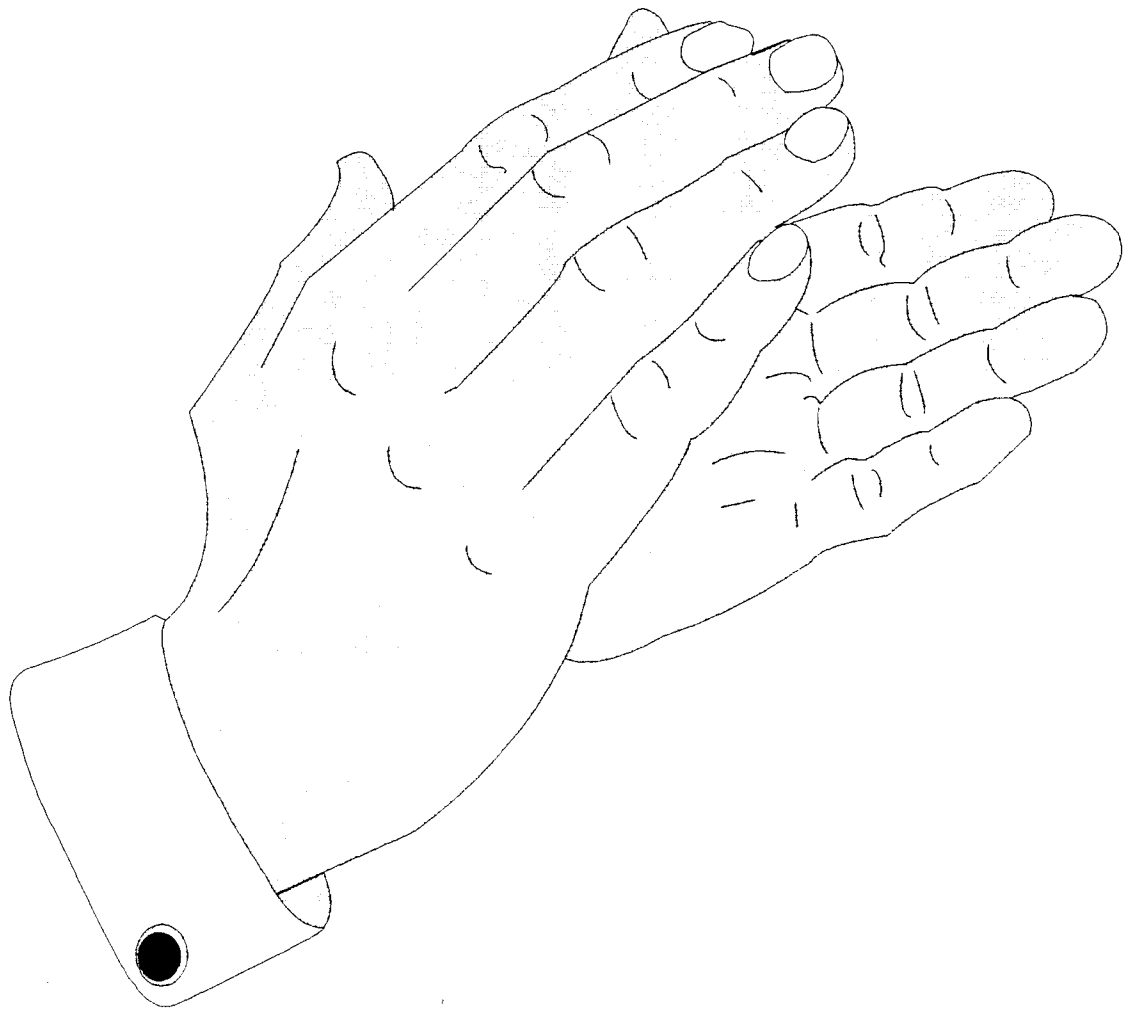
Students should continue to explore patterns in everyday life. This may include visits to museum; visits from relatives who create quilts, and a working bulletin board where students continue to add patterns. This working board will demonstrate students' appreciation for patterns and algebraic patterns.

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SNAP SNAP

SNAP SNAP

(Teacher Scoring Rubric)

Kid Friendly Pattern Rubric

- _____
- _____ I have used appropriate mathematical vocabulary when speaking and writing.
- _____ I have shown all work required.
- _____ I have restated the questions in the answer.
- _____ I have clearly explained the mathematical rules and explained how the tables function.
- _____ I recognized and labeled patterns using variables. (AAB, AAB, AAB,...)
- _____ I created and labeled my tables and used variables in stating my rule.
- _____ My work is neat and can be read easily.

- _____
- _____ I have used appropriate mathematical vocabulary most of the time when speaking and writing.
- _____ I have shown most of the work required.
- _____ I wrote my answers in complete sentences using mathematical vocabulary.
- _____ I have explained the mathematical rules and explained how the tables function.
- _____ I recognized most patterns and used variables.
- _____ I created tables and used variables when stating my rules most of the time.
- _____ My math and writing but my work needs to be more organized.

- _____
- _____ I used appropriate mathematical vocabulary sometimes.
- _____ I showed some work.
- _____ I wrote simple sentences with few mathematical words.
- _____ I recognized some patterns and used variables.
- _____ I created some tables and used variables.
- _____ My work needs organization but it is understandable.

- _____
- _____ I did not use the appropriate mathematical vocabulary.
- _____ I did not show my work or it is incomplete.
- _____ I did not write in sentences that showed understanding.
- _____ I did not recognize patterns and did not use variables.
- _____ I did not create tables or use variables.
- _____ My work is unorganized and unclear.

(Fill in grade scale used by your district.)